DOCUMENT RESUME

ED 200 008 FL 012 081

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TITLE Why Do Children Say What They Say When They Say It? An Experimental Approach to the Psychogenesis of Presupposition.
INSTITUTION Stanford Univ., Calif. Dept. of Linguistics.
PUB DATE Aug 78
NOTE 11p.; In its Papers and Reports on Child Language Development, Number 15, p57-67, Aug 1978. Not available in paper copy because of small type in original document.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Child Language; Infants; *Language Acquisition; Language Research; Lexicology; Prediction; Psycholinguistics
IDENTIFIERS *Presupposition

ABSTRACT

The lexical development of four infants was recorded by their parents in diaries. In a selective imitation situation, individualized for each child, the responses of the children were compared with semantic predictions made on the basis of one of 14 hypothesized rules, and with the semantic alternatives available from the child's lexicon. It was found that, in general, it is possible to predict what a child will say and when on the basis of the structure of a referential event. The research is deemed supportive of the notion that the distinction between information and certainty is the psychological basis for the distinction between assertion and presupposition in language, i.e., changing, informative elements are expressed on a background of unexpressed certainties. (JB)

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WHY DO CHILDREN SAY WHAT THEY SAY WHEN THEY SAY IT?: AN EXPERIMENTAL APPROACH TO THE PSYCHOGENESIS OF PRESUPPOSITION.*

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Given a child at the one-word stage who is encoding a complex event, but is limited to uttering but a single word, can we characterize which element of the referential event will be selected for verbal expression? For instance, when the child says down, coming down the stairs, he is expressing change of state of himself as agent. The awareness of self as agent completes the implied semantic relation, but agent is not expressed verbally. If, however, the child is at a point in his or her cognitive and linguistic development where he or she is able to express either of the component functions (e.g., agent, action), and where he or she also possesses the specific vocabulary appropriate to express those functions in this particular situation (e.g., me, down), what factors determine the choice of one of these elements for linguistic expression?

In our earlier work (Greenfield, Smith, and Laufer, 1972; Greenfield and Smith, 1976; Greenfield, 1978) we have argued that the principle of informativeness can generally explain which element is selected. Informativeness is used in the information theory sense of uncertainty. Uncertainty exists where there are possible alternatives; that element among possible alternatives which reduces uncertainty the most is considered to be the most informative. But uncertainty must be defined from the child-speaker's point of view. In order to validate the nature of the child's point of view, we must construct hypotheses about how the child structures situations in terms of the distribution of information and certainty and see if these hypotheses are borne out by the facts of semantic choice in these different sorts of situations.

Our view is that the state of certainty or the process of taking for granted is the cognitive basis for presupposition, while perception of uncertainty or change is the cognitive basis for assertion. In the one-word stage, what is taken for granted goes unstated by the child, while informative or changing elements are given verbal expression in the single word utterance.

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Papers and Reports on Child Language Development, Number 15

Specific Rules

This conceptualization generated a series of specific rules to account for the linguistic encoding of the referential events used in our study. While most of the rules were formulated in advance, a few (marked*) were formulated after looking at the data. It was considered more important to find out if a body of rules existed which could account for semantic choice than to adhere strictly to the hypothetico-deductive model by formulating all rules in advance. The ex post facto rules should of course be predictively validated in future studies.

Transitive events

1) When an agent is making an object undergo a change of state at a distance from the speaker, perception of that event is likely to involve a shift of focus to the object in question. The identity of the object is uncertain. Hence the object becomes a topic that is not taken for granted and will, therefore, be expressed.

2) When an object is in the speaker's possession or is being acted upon by the speaker, it is generally taken for granted through its connection with the self; its identity is not in question; and it will therefore go unexpressed. When the object is being acted on, uncertainty will inhere in the change of state, which will be expressed.

3) If an object belonging to another person is given or is in the process of being given to the child/speaker, the object is taken for granted and the possessor is expressed verbally.*

4) When the child is showing an object to another person, there is no change of state to express (Rule 2) and so the object is named.*

Intransitive events

5) When another animate being is acting, the speaker's attention is likely already to be focused on the actor, who therefore represents a constant in the situation. The actor as topic goes unexpressed and the action, representing a change in the situation, receives verbal expression.

6) When the speaker is acting, the self as agent is taken for granted, and the action receives verbal expression. Another way of looking at this situation is to say that the agent is a constant while the action represents a change in the situation.

All events

7) If the most uncertain and informative element within a single referential event is unsuccessfully expressed, it remains uncertain and informative. There-

fore, if the child continues to encode the situation verbally, he will persist in encoding that element until successful.*

8) If the referential event is immediately repeated, there is no change in the relative certainty and informativeness of the different elements. Therefore, if the child continues to encode the situation verbally the child will express the same element again.*

9) Once the most uncertain or informative element in a single referential event involving two elements has been given verbal expression, it becomes more certain and less informative. At this point, then, if the child continues to encode the situation verbally, he will now express the other aspect, heretofore unstated.

Subsequent events in an event sequence

10) If, in a sequence of events, the action (including locative action) remains constant while the object varies, the object will be given verbal expression .

11) If, in a sequence of events, the object remains constant while the action varies, the action will be given verbal expression.

12) If, in a sequence of events, the object remains constant while the location changes, the location will be given verbal expression.

13) If, in a sequence of events, the possessor remains constant and the object varies, the object will be given verbal expression.

14) If, in a sequence of events, the object remains constant and the possessor varies, the possessor will be given verbal expression.

(In the rare case where two rules could apply to the same situation, Rules 10 through 14 override all others.)

According to our earlier findings (Greenfield and Smith, 1976), agents are informative only when 1) they are absent or 2) there is a conflict over agency. Because such situations were not included in our study, none of the rules predict the expression of agent.

A Method of Individualized Experiments

Before discussing our tests of these predictive rules, we would like to introduce and discuss a new methodological concept--the individualized experiment--which we developed in the context of the present study. The individualized experiment deals with the problem of stimulus equivalence. The basic concept is that what is held constant across subjects is not the physical characteristics of the stimuli but the functional relations between subject and stimuli.

In the present study, the important functional relationships between child-participants and stimuli are the following: 1) The items relevant to a particular procedure must be in the participant's lexicon; 2) the participant must have used a particular lexical item in reference to the physical stimuli actually used in the experiment; 3) the participant must have shown evidence of the ability to express, in single-word utterances, all the semantic functions assumed by the procedure; 4) the experimenter and surroundings must be maximally familiar to the participant (to achieve this aim, the mother served as experimenter and the experiment was carried out in the child's home). Each of the children in our sample had in fact a different lexicon, used lexical items in reference to different people, actions, and things, had a slightly different set of semantic functions available, and lived in different physical and social environments.

An important problem addressed by the individualized experiment is that of individual prediction. The standard types of experimental design attempt to predict only group averages. No attempt has been made to predict the behavior of any single individual. Yet the ability to predict behavior for every individual participant represents a much more precise level of behavioral understanding. Once the notion of individualizing an experimental procedure is put into practice, it is no longer possible to pool data derived from different individuals and do group analyses. The response from each subject is treated as a sample in itself. A statistical analysis is performed on each sample individually. The question asked of the statistic is then "Can one generalize about the behavior of this particular subject?" The individualized experiment thus leads to predictions on the individual level.

The Individualized Script Study: Design

Sample

The four children whose results are reported here are part of a larger longitudinal sample of babies recruited through a private pediatric practice in Los Angeles. These children were from middle-class white families. All of the mothers, except one, and the fathers were college educated. Parents of each baby were shown how to keep a diary of the child's language development. The diary focused on lexical development, stressing development of the semantic functions (Greenfield and Smith, 1976) served by each word. The diaries were started either before or just after the child's first meaningful word.

The particular children whose results are reported here are those who had reached an appropriate stage of linguistic development at the time of these experiments. An appropriate level involved productive use of the requisite semantic functions, as well as a set of lexical items from which to make a particular semantic choice. Level of linguistic development was determined by a combination of diary information and questioning of the mother immediately before the design of each child's individualized procedure.

Procedure

Our procedure was based on the notion of an individualized script. Each script was tailored to the child-participant. The scripts contained situations designed to test Rules 1-3 and 9-14, as described in the section on specific predictions. Evidence for Rules 4-8 lies in unscripted behavior for all four children. These situations were in each case constructed from the child's current vocabulary, semantic functions, and past history (real life experiences) as determined by a combination of diary information and questioning of the mother. The mother assembled the necessary props, composed of familiar objects, in advance.

The basic method was selective imitation. That is, the mother as experimenter would follow the script, carrying out certain actions and describing them verbally or asking the child to do various things. The child's verbal expression would consist in selectively imitating some aspect of the mother's utterance. The use of imitation as an experimental technique is based on Piaget's basic discovery that imitation, far from being a mechanical procedure, reflects as much about the cognitive structure of the imitator as it does about the characteristics of the model.

A portion of Alice's script is now presented to illustrate how these notions were actualized in practice. The scripted action appears in Roman type; the speech is underlined. Next to the scripted action and speech is listed the applicable rule (from the section on specific predictions), the resultant prediction in that instance, and the alternative semantic possibilities available in the child's vocabulary. The requisite semantic functions for a given item type are listed before each type is presented.

Scripted Action Speech	Applicable Rule	Semantic Prediction	Semantic Alternative
1) Constant action, variable object (when Alice comes in from outside)			
Can you take your hat off?	Rule 2	Action off	Object hat
Can you take your jacket off?	Rule 10	Object jacket	Action/State off
Can you take your shoes off?	Rule 10	Object shoes	Action/State off
Can you take your socks off?	Rule 10	Object socks	Action/State off

The Individualized Script Study: Results

Is it possible to predict what a child will say when? Our answer is a qualified yes. There are two major qualifications. The first is that we have made no attempt to predict silence. Our predictions are therefore of the type, "If the child speaks now, she will say X." The second is that most children did not accept and respond to our script most of the time. The specific predictions were, however, based on principles that can be applied to a wide variety of situations. When these situations occurred, it was possible to apply these principles postdictively. For most children, it was necessary to combine utterances relating to spontaneously created events with those produced in response to the script in order to have a statistically analyzable sample for each child. In addition, as mentioned earlier, four of the rules were formulated after the data had been collected.

Quantitative Results

Informativeness. The principle of informativeness accounted for the actual semantic choices of all four children in the great majority of cases. Table 1 presents a summary of these data. Only the first verbal response to a referential event or adult utterance was counted for purpose of these statistics, since the probability of expressing an alternative aspect of an event rises once a given aspect has already been expressed. Hence, no instances of Rules 7 and 9 appear in the table, as these deal with later verbal response to one single event.

The chance probability of a correct prediction was considered to be .5 for purposes of the tests. This assumption leads to very conservative tests as the predicted choice is often one of three alternative types of semantic possibilities for each type of referential situation (e.g., a choice from among three elements: agent, action, or object).

Table 1

Frequency of Scripted and Unscripted Confirmations of Specific Predictive Rules of Informativeness

Martha* (21 months)		Jim (21 months)		Jason (23 months)		Alice (23 months)	
SCRIPTED							
confirmation 1	disconfirmation 0	confirmation 5	disconfirmation 0	confirmation 13	disconfirmation 0	confirmation 2	disconfirmation 2
1 rule 10		3,rule 2 1,rule 8•• 1,rule 11		1,rule 1 2,rule 2 2,rule 3•• 1,rule 8•• 4,rule 10 1,rule 11 1,rule 13 1,rule 14		1,rule 10 1,rule 12	1,rule 2 1,rule 3••
UNSCRIPTED							
confirmation 7	disconfirmation 2	confirmation 3	disconfirmation 0	confirmation 9	disconfirmation 3	confirmation 8	disconfirmation 0
1,rule 2 1,rule 4•• 1,rule 5 1,rule 6	1,rule 1 1,rule 2	1,rule 2 2,rule 11		5,rule 2 3,rule 4•• 1,rule 10	2,rule 2 1,rule 10	4,rule 2 2,rule 4•• 2,rule 11	
TOTALS							
8	2	8	0	22	3	10	2
p = .055		p = .004		p < .001		p = .019	

*The children are ordered from least to most advanced.
••Ex post facto rule.

The binomial test yielded clearly statistically significant results for three of the children and borderline results for the fourth (Table 1). Results for all four children are in the predicted direction. Probability levels are presented in the table. As Table 1 shows, most children did not follow the script frequently enough to permit separate analyses of the scripted behavior. In addition, several rules were formulated after the data had been collected. If we eliminate unscripted behavior and ex post facto rules, only Jason provides a body of data large enough to test the purely predictive power of the rules. There are ten examples where Jason followed the script and the script tested rules formulated in advance. In all such cases, the predictions were confirmed by Jason's actual semantic choices. According to the binomial test, the probability of these results for Jason occurring by chance is .001. In the case of this one child, rules generated by the principle of informativeness enabled us to predict quite exactly what he would say when. In the case of the other 3 children, for whom postdiction was necessary, it would be more accurate to conclude that these same rules allow us to understand their semantic choices in the great majority of instances.

Stress. If the caretaker stresses a certain lexical item in the utterance prior to the child's turn, does this emphasis influence what the child will say? In order to investigate this potential explanation, both scripted and unscripted confirmations and disconfirmations of the predictions were tallied with respect to stress in the caretaker's prior utterance. Eighty-four percent of the time either there were in the caretaker's prior utterance several stressed elements, no stressed element, a single stressed element which was not repeated by the child, or there was no immediately prior caretaker utterance. In all four cases, emphasis can not determine the child's choice. Only 16% of the children's utterances reflected the single stressed element in the caretaker's prior turn. There was, therefore, virtually no evidence to support the notion that stress in the caretaker's prior utterance accounted for the child's selection of an element to express.

Qualitative Results

The following selection represents examples of Rules 1, 7, 9, and 11. (See Greenfield and Zukow, in press, for examples of the other rules.)

Ordinary type indicates the referential event; underlining shows what is said. Individual words are placed under the particular aspect of the event to which they refer. The mother's utterances are in standard English orthography. The child's utterances are written phonetically according to the transcription conventions of Ladefoged (1975) and enclosed in brackets. Underneath the phonetic transcription, the child's utterances have been translated into standard English orthography. For the most part we follow the conventions of Sachs, Schegloff, and Jefferson (1974) for the verbal transcription. Double underlining (shoe) indicates changes in pitch and intensity. The end of an utterance is represented by an oblique (/). Contextual notes are enclosed in double parentheses. Colons (: or ::) indicate syllable lengthening.

Example: Constant object, variable action.

Mother	Jason	Applicable Rule
(Mother putting jacket on) Look Mommy's putting jacket on/	Jason looking at and approaching mother	
	[dʒækʌt] jacket	R. 1
	[dʒæ:kʌt]	R. 7
(barely audible) Mm hm/	[dʒæ::kʌt]	R. 7
Here the ja:cket's on/	[dʒækʌ:t]	R. 7
(Mother taking jacket off) Now Mommy's taking the jacket off/	[ɑn] on	R. 9
	[ɑ:f] off	R. 11

In this exchange, the child starts by naming the object undergoing a change of state at a distance (Rule 1). Unsuccessful utterances are repeated until the utterance is acknowledged (Rule 7). Mm hm does not acknowledge "what" was said only that "something" was said. When the mother expands the child's prior utterance, thereby acknowledging that utterance, Alice goes on to encode the next most informative element (Rule 9). In the next referential event the object remains constant while a further change of state occurs. This change is expressed (off, Rule 11).

This example shows how rules derived from the principle of informativeness operate a in specific concrete situation. The reader should now have a better idea of the nature of the behavior which produced the statistical results presented earlier.

Conclusion

Our intention has been to show the relations between the structure of a referential event and what the child selects to express linguistically. Central to our argument is the notion that the distinction between information and certainty is the psychological basis for the distinction between assertion and presupposition in language. That which is presupposed, taken for granted, is more certain and, therefore, left unexpressed or expressed later. The changing, informative elements are expressed first. For the young child what is taken for granted is presupposed by virtue of being situated in the "here and now." In adult communication presuppositions are often hypothetical and complex. However, the cognitive basis for presupposition remains the same: the certainties that must exist as a background for the present assertion.

In order to test our hypotheses concerning certainty and information we have developed a new methodology of individualized experiments in which stimuli are functionally equivalent across children but particularized for the individual child. In this method the data for each child receive separate statistical analysis. The goal is, therefore, to predict the behavior of each and every subject, not just group averages as in the usual methods of statistical analysis. This methodology seems particularly valuable for areas like child language research where it permits an integration of qualitative and quantitative analysis.

From inferences made about the child's point of view we were able to account for a large proportion of the children's utterances. The notion of informativeness has extended our ability to predict what children say when they speak and appears to hold promise for increasing our knowledge of the relationship between cognition and communication.

Notes

This research was sponsored by the Spencer Foundation. The authors would like to thank Martha Platt for her helpful comments and suggestions in collecting pilot data. The authors wish to express their appreciation to the children and their families and to Kenneth Keer, M.D. and Arnold H. Zukow, M.D., Encino, California.

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